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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

KANG, INSUN

ART UNIT	PAPER NUMBER
2124	

2124

DATE MAILED: 05/20/2004

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No. 09/839,910	Applicant(s) ROBISON, ARCH	
Examiner Insun Kang	Art Unit 2124	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) Responsive to communication(s) filed on 19 April 2001 and 16 August 2001.
- 2a) This action is FINAL.
- 2b) This action is non-final.
- 3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) Claim(s) 1-21 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) Claim(s) _____ is/are allowed.
- 6) Claim(s) 1-21 is/are rejected.
- 7) Claim(s) _____ is/are objected to.
- 8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) The specification is objected to by the Examiner.
- 10) The drawing(s) filed on 16 August 2001 is/are: a) accepted or b) objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) All b) Some * c) None of:
1. Certified copies of the priority documents have been received.
2. Certified copies of the priority documents have been received in Application No. _____.
3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) Notice of References Cited (PTO-892)
- 2) Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) Notice of Informal Patent Application (PTO-152)
- 6) Other: _____

DETAILED ACTION

1. This action is responding to application papers dated 4/19/2001 and 8/16/2001.
2. Claims 1-21 are pending in the application.

Specification

3. Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

The language should be clear and concise and should not repeat information given in the title. It should avoid using phrases which can be implied, such as, "The disclosure concerns," "The disclosure defined by this invention," "The disclosure describes," etc.

4. The abstract of the disclosure is objected to because the abstract repeats information given in the title (first sentence of the abstract) and it contains an improper word "[0078]" in line 1. Correction is required. See MPEP § 608.01(b).

5. The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use.

Arrangement of the Specification

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

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- (a) TITLE OF THE INVENTION.
- (b) CROSS-REFERENCE TO RELATED APPLICATIONS.
- (c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
- (d) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC (See 37 CFR 1.52(e)(5) and MPEP 608.05. Computer program listings (37 CFR 1.96(c)), "Sequence Listings" (37 CFR 1.821(c)), and tables having more than 50 pages of text are permitted to be submitted on compact discs.) or REFERENCE TO A "MICROFICHE APPENDIX" (See MPEP § 608.05(a). "Microfiche Appendices" were accepted by the Office until March 1, 2001.)
- (e) BACKGROUND OF THE INVENTION.
 - (1) Field of the Invention.
 - (2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.
- (f) BRIEF SUMMARY OF THE INVENTION.
- (g) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
- (h) DETAILED DESCRIPTION OF THE INVENTION.
- (i) CLAIM OR CLAIMS (commencing on a separate sheet).
- (j) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
- (k) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

A brief summary of the invention is missing in the specification. See MPEP § 608.01(d).

6. The disclosure is objected to because of the following informalities: In paragraph 002, there appears to be a missing sentence(s) before the phrase "A well known technique that solves this disadvantage of conventional compilation systems." There is no previous discussion of "this disadvantage."

Appropriate correction is required.

Specification

7. A substitute specification in proper idiomatic English and in compliance with 37 CFR 1.52(a) and (b) is required. The substitute specification filed must be accompanied by a statement that it contains no new matter. ¶ 6.28.01
Substitute Specification Required by Examiner.

Claim Rejections - 35 USC § 112

8. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claim 5-7, 12-14 and 19-21 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 6, 13 and 20 recite the limitation "the lattice values" in line 2 (claim 6), 4 (claim 13) and 2 (claim 20). There is insufficient antecedent basis for the limitation in the claims.

Per claims 5-7, 12-14 and 19-21, the claims are generally narrative and indefinite, failing to conform with current U.S. practice. They appear to be a literal translation into English from a foreign document and are replete with grammatical and idiomatic errors.

Double Patenting

10. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11

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F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

11. Claims 2-21 are provisionally rejected under the judicially created doctrine of obviousness-type double patenting over claims 7, 14 and 21 of copending Application No.09/844345 (US Pub. No. 2002/0162096).

Although the conflicting claims are not identical, they are not patentably distinct from each other because they are directed to substantially the same invention and recites only obvious differences which would have been obvious to one of ordinary skill in the art of program development at the time of invention such as simply (i) omitting/adding steps or elements along with their functions, and/or (ii) implementing the method steps with means for performing the steps, and/or (iii) computer program implementation of the method, and/or (iv) implementing a system, a computer-readable medium having computer program for performing the method steps, as explained below.

The corresponding claims are as follows:

Instant claims:

copending claims:

7, 14 and 21

5, 19 and 33

Per claim 7:

Copending claim 5 recites

- analyzing each routine, of a software program having a plurality of separately compilable routines, to create a plurality of local side-effect problems for each routine (“pruning local graphs representing local problems, the local problems corresponding to separately compilable components in a software program”)
- merging the local side-effect problems to create a global side-effect problem (“the global problem being represented by a global graph formed from the pruned local graphs”)
- computing a global solution to the global problem and splitting the global solution into local solutions (“solving a global problem to optimize a recompilation of the separately compilation components by an inter-procedural analysis(IPA) solver, the global problem being represented by a global graph formed from the pruned local graphs”)
- determining for each routine, whether a pointer parameter within the routine is used to write to or read from a storage device and to derive a return value of the routine (“determining final edges and vertex values of the local graphs to be sent to IPA solver”)
- computing a lattice value associated with each of the pointer parameters, wherein the lattice value comprises one of a PURE effect; LOST effect; RETURN effect; OUT effect; IN effect; RETURN, OUT, and IN effect; RETURN and OUT effect; RETURN and IN effect; and OUT and IN effect (“pre-solving a subgraph of each of the local graphs)

- providing the lattice values to an interprocedural analysis solver to optimize compilation of the software program ("solving a global problem to optimize a recompilation of the separately compilation components by an inter-procedural analysis (IPA) solver, the global problem being represented by a global graph formed from the pruned local graphs. Sending the final edges and vertex values to the IPA solver)

-representing the local side-effect problems as directed graphs having edges and vertices, wherein each edge has an associated monotone transfer function; each vertex has a vertex value, wherein the vertex value is one of formal parameter, implicit parameter, local pointer variable, or gate parameter; and a subset of vertices is marked with lattice values ("the local problems corresponding to separately compilable components in a software program, each of the local graphs having edges and vertices, each edge having a transfer function, each vertex having a value, values of each of the local graph forming a lattice under a partial ordering").

The instant claim does not explicitly recite the steps of pruning and local graphs representing local problems to create a global problem, as recited in co-pending claim 5. It would have been obvious for one of ordinary skill in the art of program development at the time the instant invention was made to modify the co-pending method by omitting the step of pruning local graphs representing local problems to create a global problem recited in co-pending claim 5 for the purpose of expediting the method.

Per claim 14:

The instant claim recites a system corresponding to copending claim 33 respectively, modified in the manner set forth above in connection with claim 7 respectively. It would have been obvious for one of ordinary skill in the art of program development to implement the copending method modified in the manner set forth above with a system including means for performing the steps of the copending method.

Per claim 21:

The instant claim recites a computer-readable medium corresponding to copending claim 19 respectively, modified in the manner set forth above in connection with claim 7 respectively. It would have been obvious for one of ordinary skill in the art of program development to implement the copending method modified in the manner set forth above with a computer-readable medium including means for performing the steps of the copending method.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claim Rejections - 35 USC § 102

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12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

13. Claims 1-21 are rejected under 35 U.S.C. 102(e) as being anticipated by Cheng et al. (US Pub. No. 2002/0010911) hereinafter referred to as "Cheng."

Per claim 1:

Cheng discloses:

- analyzing each routine, of a software program having a plurality of separately compilable routines, to create a plurality of local side-effect problems for each routine

("In compiling a program, the present algorithm first analyzes each function in the program as an isolated compilation unit... This stage of the algorithm, the

intraprocedural phase, will summarize the intraprocedural behavior of a

function...including how it can affect memory accesses in the caller and callee

functions, and how its memory accesses can be affected by the caller and callee

functions," pg 1, 0008)

-merging the local side-effect problems to create a global side-effect problem ("In the

interprocedural stage, bottom-up propagation of summary transfer functions along the

call graph is performed," pg 2, 0027)

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as claimed.

Per claim 2:

The rejection of claim 1 is incorporated, and further, Cheng discloses:

- computing a global solution to the global problem (pg 2, 0025) and splitting the global solution into local solutions ("top-down propagation of function names along the partially resolved call graph is also conducted, since some indirect call-sites may receive concrete function names through parameters... The aliases among formal parameters are then calculated after top-down propagation of concrete values along the complete call graph," pg 2, 0027)

as claimed.

Per claim 3:

The rejection of claim 2 is incorporated, and further, Cheng discloses:

- determining for each routine, whether a pointer parameter within the routine is used to write to or read from a storage device ("To accommodate their **side-effects** appropriately in the interprocedural pointer analysis stage, each library function with side-effects are written with template statements," pg 11, 0107; If a function pointer is resolved by accommodating **the side-effects of the callees**, re-evaluating the access path of the indirect call-site will find the propagated function name pg 10, 0101; pg 11, 0108; pg 8,0081; pg 1, 0008; pg 6, 0073) as claimed.

Per claim 4:

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The rejection of claim 3 is incorporated, and further, Cheng discloses:

- determining for each routine whether the pointer parameter is used to derive a return value of the routine ("the summary transfer function of memcpy will include points-to relation (f_1_mem*, f_2_mem**), which will be processed in the interprocedural stage to expose the effect of the hidden pointer assignment in memcpy,"pg 11, 0108; pg 5, 0045; pg 6,0060) as claimed.

Per claim 5:

The rejection of claim 4 is incorporated, and further, Cheng discloses:

- computing a lattice value associated with each of the pointer parameters, wherein the lattice value comprises one of a PURE effect; LOST effect; RETURN effect; OUT effect; IN effect; RETURN, OUT, and IN effect; RETURN and OUT effect; RETURN and IN effect; and OUT and IN effect ("Pointer assignments in each function are analyzed by their lexical order to calculate the points-to relations," pg 6, 0071; 0027; "The aliases among formal parameters are then calculated after top-down propagation of concrete values along the complete call graph (pg 2, 0025-0027) as claimed.

Per claim 6:

The rejection of claim 5 is incorporated, and further, Cheng discloses:

- providing the lattice values to an interprocedural analysis solver to optimize compilation of the software program (abstract; Pg 2,0025-0028) as claimed.

Per claim 7:

The rejection of claim 6 is incorporated, and further, Cheng discloses:

-representing the local side-effect problems as directed graphs having edges and vertices, wherein each edge has an associated monotone transfer function; each vertex has a vertex value, wherein the vertex value is one of formal parameter, implicit parameter, local pointer variable, or gate parameter; and a subset of vertices is marked with lattice values (pg 3, 0027-0029; pg 8, 0086; pg 11, 0102-0103).

Per claims 8-14, they are the computer-readable medium versions of claims 1-7, respectively, and are rejected for the same reasons set forth in connection with the rejection of claims 1-7 above.

Per claims 15-21, they are the system versions of claims 1-7, respectively, and are rejected for the same reasons set forth in connection with the rejection of claims 1-7 above.

14. Claims 1-21 are rejected under 35 U.S.C. 102(e) as being anticipated by Archambault (US Patent 6,173,444).

Per claim 1:

Archambault discloses:

- analyzing each routine, of a software program having a plurality of separately compilable routines, to create a plurality of local side-effect problems for each routine ("intraprocedural information about pointer variables referenced in each function of the

program is gathered and saved in a data structure called the pointer alias graph," col 3 lines 5-67 and col 4 lines 1-12; "the initial intraprocedural analysis phase to develop a pointer alias graph for each function for later use in the middle interprocedural analysis phase," col 4 lines 34-39; "a local scalar data dependence graph for each basic block of the program. This local analysis is used to form a global data dependence graph that shows data dependencies in the context of a control flow graph within a single function that can be used for later optimizations in the compiler," col 1 lines 40-47)

-merging the local side-effect problems to create a global side-effect problem ("a middle phase in which the pointer alias graphs from all the compilation units for the program are combined to form a universal pointer alias graph," col 4 lines 1-13; "A definition nodes (from the accumulated graphs) for each pointer variable are merged into a single definition node, and the alias sets of each of the nodes are combined(union) to form the universal alias set for a specific pointer variable," col 7 lines 24-45).

Per claim 2:

The rejection of claim 1 is incorporated, and further, Archambault discloses:

-computing a global solution to the global problem ("utilizes interprocedural analysis, a second pass performed at link time, in which the collected information is merged and used to compute an interprocedural solution," col 4 lines 19-40)

-and splitting the global solution into local solutions ("alias sets are propagated for all pointer variables in the universal graph," col 7 lines 35-67; "Each of the files is

recompiled performing the intraprocedural algorithm using the final universal pointer alias graph as input," col 8 lines 7-16).

Per claim 3:

The rejection of claim 2 is incorporated, and further, Archambault discloses:

- determining for each routine, whether a pointer parameter within the routine is used to write to or read from a storage device (col 7 lines 33-67)

Per claim 4:

The rejection of claim 3 is incorporated, and further, Archambault discloses:

- determining for each routine whether the pointer parameter is used to derive a return value of the routine (col 8 lines 20-67)

Per claim 5:

The rejection of claim 4 is incorporated, and further, Archambault discloses:

- computing a lattice value associated with each of the pointer parameters, wherein the lattice value comprises one of a PURE effect; LOST effect; RETURN effect; OUT effect; IN effect; RETURN, OUT, and IN effect; RETURN and OUT effect; RETURN and IN effect; and OUT and IN effect (col 5 lines 52-67 and col 6 lines 1-39 and 60-67)

Per claim 6:

The rejection of claim 5 is incorporated, and further, Archambault discloses:

- providing the lattice values to an interprocedural analysis solver to optimize compilation of the software program ("transitive closure is performed on the universal pointer alias graph to produce a reduced graph containing the list of objects that each

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pointer variable can point to. In the final phase, all the files are re-compiled using the universal pointer alias graph as input," abstract; col 9 lines 18-23) as claimed.

Per claim 7:

The rejection of claim 6 is incorporated, and further, Archambault discloses:

- representing the local side-effect problems as directed graphs having edges and vertices ("all of the pointer graphs developed through the intraprocedural pass," col 7 lines 24-67 and col 8 lines 1-16) wherein each edge has an associated monotone transfer function (col 7 lines 24-67 and col 8 lines 1-16) each vertex has a vertex value, wherein the vertex value is one of formal parameter, implicit parameter, local pointer variable, or gate parameter; and a subset of vertices is marked with lattice values (col 7 lines 24-67 and col 8 lines 1-16) as claimed.

Per claims 8-14, they are the computer-readable medium versions of claims 1-7, respectively, and are rejected for the same reasons set forth in connection with the rejection of claims 1-7 above.

Per claims 15-21, they are the system versions of claims 1-7, respectively, and are rejected for the same reasons set forth in connection with the rejection of claims 1-7 above.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Insun Kang whose telephone number is 703-305-6465.

The examiner can normally be reached on M-F 8:30-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kakali Chaki can be reached on 703-305-9662. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

IK
4/23/2004

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